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Circular 12

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TICKS

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April 1942



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# INSECTS IN RELATION

## TO

### NATIONAL DEFENSE

#### Circular 12 - Ticks

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#### Table of Contents

	Page
Introduction.....	1
Kinds of Ticks.....	3
Life Histories and Habits.....	6
How to Avoid Tick Attack and Infection....	11
Precaution Against Tick Bites.....	12
How to Reduce the Danger of Disease	
Infection by Tick Bites.....	13
Control of Wood Ticks.....	16
Control of the Brown Dog Tick.....	19
Control of Horse Ticks and Cattle Ticks...	22
The Spinose Ear Tick.....	23
References.....	24

#### INTRODUCTION

Several species of ticks freely attack people. Some of these carry diseases and others are more important as annoyers either by their presence or by their bites. Certain kinds of ticks are also important as parasites or transmitters of diseases of domestic animals, poultry and livestock.

Ticks, although often referred to as insects, are not true insects, but arachnids, related to the mites and spiders. They feed only on the blood of animals, to which they attach themselves by burying their mouthparts in the skin. Although mating of males and females frequently occurs while the females are attached to

an animal and feeding, eggs are never laid while the female is still on the host, but only after it has dropped to the ground. For this reason, an increase in the infestation of ticks on an animal occurs only by the attachment of other ticks and never by the breeding on the animal of those already attached.

Ticks are widely distributed geographically, but in any one locality their occurrence is usually limited to a few favorable areas. Certain species are most commonly found on one's clothing or attached to one's person after walking through areas covered with brush or high grass. Other species are encountered attached to dogs, horses, and other domestic animals. Many species are found attached only to wild animals, such as opossums, skunks, rabbits, or field mice. Some infest dry caves, and some frequent the bedding places of deer and other animals, ready to feed on sleeping animals or persons. One species frequently infests houses and buildings.

Rocky Mountain spotted fever of man is carried by the common wood tick (Dermacentor andersoni Stiles) in the Rocky Mountain region, and by the American dog tick (D. variabilis (Say)) in the Middle Western and Eastern States. Both species may also transmit rabbit fever or tularaemia. In the case of both of these diseases only a small percentage of the ticks are infected. A form of ascending paralysis is also caused occasionally by the attachment of these ticks especially at the base of the head. The symptoms usually subside when the parasite is removed. Relapsing fever is transmitted by several species belonging to the genus Ornithodoros which occur in the West and Southwest. The cattle tick, Boophilus annulatus Say, carrier of tick fever of cattle, has now been eradicated from most of the United States, but is still to be found in parts of Texas and Florida and in the Caribbean region. Ticks are frequently sufficiently abundant to cause serious injury to animals through direct irritation and loss of blood.



The spinose ear tick, Ornithodoros megnini Dugès, often gives serious trouble by attaching itself deep in the ears of man, horses, and other livestock.

In tropical Africa the tick, Ornithodoros moubata (Murray), is common in habitations of man and animals, and transmits African relapsing fever of man. Human tick bite fever of Lourenço Marques is transmitted mainly by the larvae of Amblyomma hebraeum Koch.

Australian human tick paralysis is caused by either Ixodes ricinus (L.) or I. holocyclus (Neum.). This disease does not appear to be very common and its cause is similar to that of the tick paralysis referred to above.

#### KINDS OF TICKS

There are two main groups or families of ticks: those with a flexible or leathery body (Argasidae), fig. 1., and those with more or less armored or hard body (Ixodidae), fig. 2.

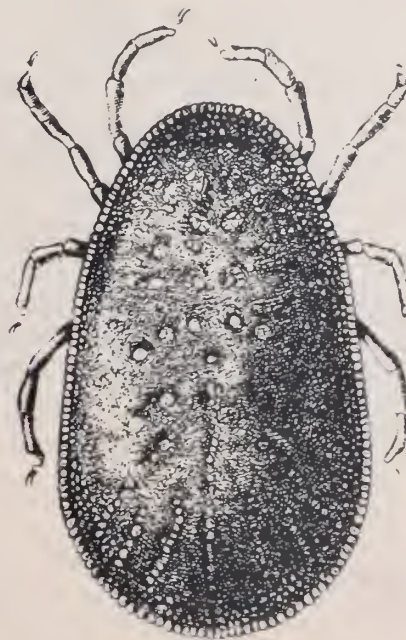


Fig. 1 - A soft-bodied tick. The fowl tick, Argas miniatus Koch, female.



Fig. 2 - A hard-bodied tick. The Rocky Mountain spotted fever tick, Dermacentor andersoni (Stiles) male.

Several different kinds of ticks are encountered in the woods and brush, and these are often spoken of as "wood ticks." These attack man more or less freely and also attach themselves to livestock. The species commonly referred to as wood ticks are often different in various sections of the country, and therefore common names which are more specific have been assigned. These species and their distribution are indicated below. The males have the backs covered with a hard shell and often present quite a different appearance from the females. The females have a hard plate (shield, or scutum) over the head end of the body. The rear portion being capable of great distention as blood is imbibed. The newly hatched tick (larvae or seed ticks) and the nymphs (second stage) have a similar shield.

The Rocky Mountain spotted fever tick, D. andersoni Stiles, is widely distributed in the Rocky Mountain region. The American dog tick, D. variabilis Say, occurs in many states outside the Rocky Mountain region. It is most abundant in the Atlantic coastal areas and the Mississippi Valley. The Pacific coast tick, D. occidentalis Marx, occurs in California and Oregon. The lone star tick, Amblyomma americanum (L.), is found from Texas to Missouri and eastward to the Atlantic coast. The Cayenne tick, A. cajennense (Fabr.), is a troublesome species in southern Texas, Mexico, the West Indies, and parts of Central and South America. The black-legged tick, Ixodes ricinus scapularis (Say), is common in the Gulf and Atlantic Coast states; and I. r. californicus (Banks), the California black-legged tick, in the Pacific Coast states.

Among the soft-bodied ticks of the genus Ornithodoros there are several species which superficially resemble each other in the seed tick and nymphal as well as the adult stages. These are found mainly in caves, hollow trees, and the burrows of animals. The males and females are capable of engorgement with blood. Another soft-bodied species is the fowl tick, Argas miniatus Koch, which is a serious pest of poultry and occasionally bites man, fig. 1.

One of this group, the spinose eartick, O. megnini Dugès, is prevalent in the arid and semi-arid southwestern United States, Mexico, and Central America. Another species, known as Ornithodoros turicata Dugès, that is found in caves and animal burrows frequently invades houses and other buildings and freely attacks man. It is known to transmit relapsing fever to man. This is also true of several closely related species.

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Because of the similarity in appearance of many species of ticks, accurate identification of the species can be made only by a specialist familiar with the distinguishing characters. The Bureau of Entomology and Plant Quarantine, United States Department of Agriculture, Washington, D. C., will identify specimens submitted. Specimens should be preserved in small vials of 70% alcohol or 2% formalin. If well packed in absorbent material to prevent breakage and leakage, they may be mailed in these containers. If alcohol or formalin is not available, specimens may be lightly crushed and placed between folds of paper prior to mailing. All specimens should be accompanied with information as to locality and date of collection, conditions where found, including kind of animal with which associated.

#### LIFE HISTORIES AND HABITS

The life history and habits of different kinds of ticks vary greatly.

All ticks pass through at least three stages of development: the egg (fig. 3), the seed tick or larva, having six legs (fig. 4), the nymph (fig. 5), and the adult, male and female (figs. 6 and 7). In general, ticks feed upon

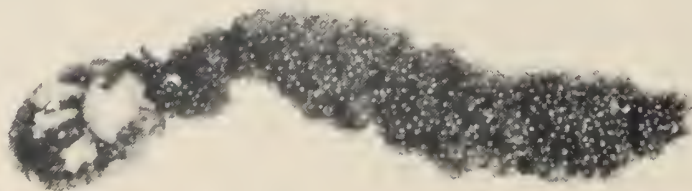


Fig. 3 - Female tick with egg mass.





Fig. 4 - Seed tick or larva, unengorged. American dog tick, Dermacentor variabilis (Say).

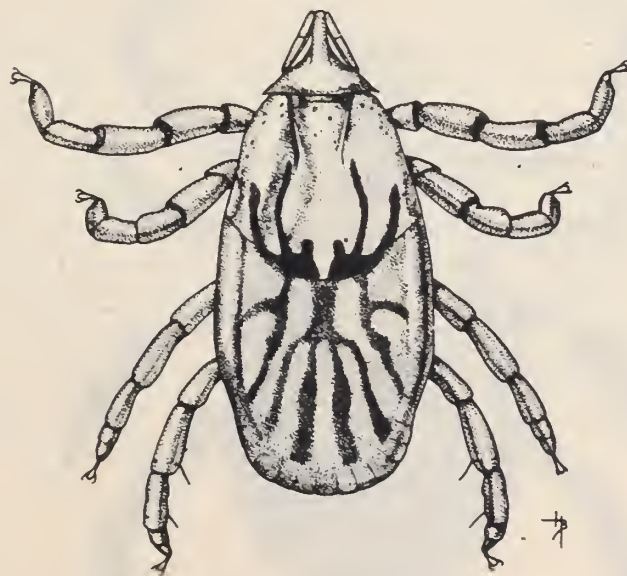


Fig. 5 - Nymph, unengorged. American dog tick, Dermacentor variabilis (Say).



Fig. 6 - Male. American dog tick, Dermacentor variabilis (Say).



Fig. 7 - Female, unengorged. American dog tick, Dermacentor variabilis (Say).

blood in the seed tick, nymphal, and adult stages, and molt their skins between each feeding. There may be two or more nymphal stages in the case of the soft-bodied ticks. The soft-bodied ticks also differ from the others by their habit of filling quickly with blood (30 minutes to an hour) and hiding away much as do bed bugs, while the hard back ticks remain attached for several days (5 to 15 or even longer). Another distinct difference is that the soft-bodied ticks may feed several times as adults, the females depositing a mass of eggs between blood meals. The females of the hard-back ticks, on the other hand, become greatly distended with blood, then drop off, seek protected places on the ground, deposit several thousand eggs, and die (fig. 3).

The incubation period in most species varies from 2 or 3 weeks in warm weather, and as a rule the minute seed ticks are soon ready to attach themselves to a suitable host. The seed ticks and nymphs of some species such as the lone star tick and the cayenne tick (Amblyomma cajennense) of the tropics will attach themselves to man or most any warm-blooded animal. The seed ticks frequently crawl upon grass and cluster together in large masses. When these are touched by a man or other animal they cling to it and start crawling about rapidly and soon attach. These young stages of the spotted fever tick and American dog tick, however, rarely or never attack man. The young of the former mainly attach to and engorge on wild animals such as chipmunks, ground squirrels, and woodchucks; those of the latter, on wild mice (fig. 8). The engorgement period of seed ticks is 2 days to 2 weeks and that of the nymphs slightly longer. The molting period of seed ticks ranges

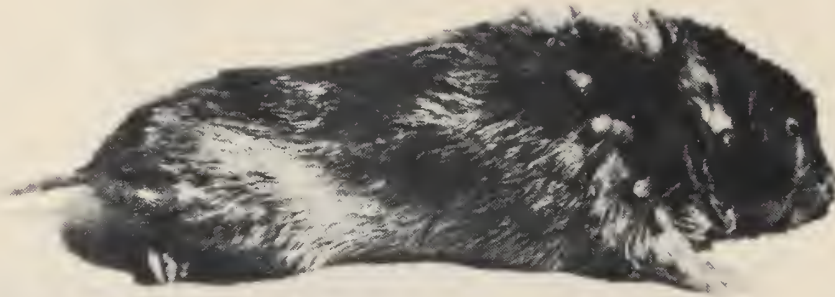


Fig. 5 - Engorged nymphs of the American dog tick attached to a meadow mouse.

from about 1 to 5 weeks and that of nymphs from 2 to 6 weeks, during moderate weather. The maximum length of life of these stages is from 7 to 10 months, or even longer under very favorable conditions.

Most ticks are long lived. The adults of some kinds may live 5 or more years without feeding. The males as well as the females of most species bite, but the former do not greatly distend with blood; the shell-like covering of their backs (fig. 6) prevents this.

In the case of many kinds of hard-back ticks such as the American dog tick the engorged seed ticks and nymphs drop to the ground and molt in protected places. Some other kinds of ticks such as the cattle fever tick (Margaropus annulatus) and the winter tick (Dermacentor albipictus Pack.) attach themselves to the host as seed ticks, engorge, molt to nymphs, and again attach themselves, engorge, and molt to adults without leaving the host until they drop as engorged females.



As indicated, some ticks will feed upon almost any kind of host; others attack only one or a few species. The brown dog tick (Rhipicephalus sanguineus Latr.) is of the latter class as it rarely attaches to any animal but the dog. The cattle fever tick is also restricted in its hosts, developing mainly on cattle, horses, and mules.

#### HOW TO AVOID TICK ATTACK AND INFECTION

Since all ticks are pests of man or some animal and are potential disease carriers they should be destroyed and their bites avoided as far as possible. This is more important, of course, where human diseases such as Rocky Mountain spotted fever, tularaemia, and relapsing fever commonly occur. The species commonly spoken of as "wood ticks" are most likely to attack man and these are the carriers of Rocky Mountain spotted fever and tularaemia.

Rocky Mountain spotted fever is widespread in the United States, having been reported in all the states of the Union with the exception of Wisconsin, Kansas, Connecticut, Vermont, New Hampshire, and Maine. The prevalence of the disease is closely correlated with the abundance of the ticks that carry it. The disease is much more prevalent in the northern Rocky Mountain regions and along the Atlantic Seaboard than elsewhere in the country, although a number of cases occur in some of the Central States, notably Iowa. The virulence of the disease varies in different areas. The most virulent form occurs in the Bitterroot Valley, Montana, and portions of Wyoming. In these areas the mortality runs from 60 to 75 percent. The form of the disease occurring in Idaho,

Washington, and Oregon is milder, the mortality running about 5 to 10 percent. In the eastern United States the virulence is intermediate, the mortality running from 20 to 25 percent. The danger of infection is, of course, dependent very largely on the abundance of ticks, although even in the areas where the disease occurs most commonly, only a small percentage of the ticks found in nature are infected. The number of infected ticks usually runs from 1 in 200 to 1 in 600.

#### Precaution against tick bites

When man is in tick-infested areas precautions should be taken to avoid tick bites and possible infection. Wearing high-top shoes or leggings, or wearing the socks over the bottom of the trousers is helpful. Most ticks crawl up from the ground or low vegetation, and the above precautions tend to keep them from crawling beneath the clothing. An occasional glance over the clothing will detect the presence of the adult ticks before they reach the belt or neckline or have an opportunity to get underneath the clothing. The minute seed ticks and relatively small nymphs are more difficult to detect and exclude. When masses of seed ticks are seen to attach to clothing many of them can be brushed off. An occasional light spraying of the clothing with kerosene extract of pyrethrum as one traverses areas where these young ticks are abundant is helpful in keeping them off. Pyrethrum, derris, or cube powder lightly dusted in the inside of the outer clothing also lends protection.

By keeping the possibility of tick infestation in mind, one will be more likely to feel them when they start to crawl on the skin, and so remove them before they have become attached.

After walking in tick-infested areas it is well to examine the outer clothing thoroughly, especially in the folds and under the collar, before entering automobiles or buildings. If ticks are very abundant in the area traversed, clothing should be removed and fumigated upon coming in from the field. If the garments are dropped loosely into a large metal container, such as a 25-pound lard can, and two teaspoonfuls of carbon tetrachloride poured over them, or the fumigant placed in a small open dish set on top of them, and the can tightly closed, all ticks will be killed in 8 hours. One should never sleep in clothing that was worn during the day, and field clothing should not be thrown on bedding when there is danger of tick infestation. Clothing of troops returning from maneuvers in tick-infested areas may be fumigated in bulk in any available tight containers.

Examine the body thoroughly for attached ticks upon retiring and arising; better still, let individuals examine each other. Pay particular attention to the hairy parts, especially the back of the head. Ticks often lie very close to the skin when first attached and are easily overlooked. Combing the hair upward with a fine-toothed comb helps reveal the presence of ticks. Prompt removal of attached ticks will prevent the development of tick paralysis.

Avoidance of bites of the soft-bodied ticks (Ornithodoros) is not easy. In choosing temporary camp sites it is well to avoid areas inhabited with ground squirrels, wood rats, and other mammals. It is advisable not to sleep on the floor of huts in the warmer parts of the world as such a practice gives opportunity for ticks of this group to bite during the night.

#### How to reduce the danger of disease infection by tick bites

If a tick is found attached, remove it at once by grasping it with the fingers or a pair of



tweezers and pulling slowly and steadily. Care should be taken to prevent breaking off the mouthparts before they are removed from the skin. In many species, such as the carriers of Rocky Mountain spotted fever, the American dog tick, and the Rocky Mountain wood tick, there is little danger of this, but in the case of the lone star tick and others having exceptionally long mouthparts, it sometimes occurs. If a bit of skin is pulled off with the tick it is evident that the mouthparts have not broken off. If it appears that the mouthparts have been left in the skin, they should be removed at once by excision. Ticks should never be allowed to remain attached for several hours. After the tick has been removed it is well to disinfect the point of attachment with a solution of carbolic acid or silver nitrate. Iodine may be used if the other materials are not at hand. This can best be done by dipping the point of a round wooden toothpick in the solution, then drilling it lightly into the skin at the exact point of attachment.

Infection may be derived from the blood of crushed ticks if it gets into the eye, nose, or mouth, or into a skin abrasion. Therefore, when one is called upon to de-tick animals repeatedly, it is better to use an insecticide rather than to pick the ticks by hand. If the ticks are picked, they should be handled with a pair of small forceps, using care to avoid tearing them open. They should then be dropped at once into boiling water, kerosene, turpentine, or alcohol. Keep the hands away from the eyes, nose, and mouth while working, and wash them thoroughly with soap and water when the job is finished. Do not allow the ticks that have been removed to escape, as they may reattach themselves to persons, and are more likely, if infected with spotted fever, to transmit the disease by a short period of attachment.



A vaccine protective against Rocky Mountain spotted fever is obtainable from the United States Public Health Service, but its production is limited.

When a person is suspected of having contracted Rocky Mountain spotted fever, all unnecessary physical exertion should be avoided and the patient promptly hospitalized under medical care. The incubation period of spotted fever in man is 2 to 12 days.

The same precautions are applicable to tularaemia (rabbit fever).

Some species of ticks, Ornithodoros (fig.9),



Fig. 9 - A relapsing fever tick, Ornithodoros turicata (Dugès) female.

transmit relapsing fever, and in the areas where these ticks occur special precautions must be taken to avoid being bitten by them. Ticks of this genus do not crawl about on the body as long as do wood

ticks before attaching themselves, and may remain attached for only a few minutes, but this short period is sufficient to permit the infected ticks to transmit the disease. One species, O. turicata, frequents dry limestone caves in certain parts of Texas, and its attack is so quick that it is almost impossible to enter such caves without being bitten. One should avoid all caves, overhanging embankments, rock ledges, and similar places in the infested region. Other species frequent dry woods, the burrows of rodents, and occasionally invade cabins. They are much more difficult to avoid, but fortunately their distribution is quite localized in the Western States, particularly Texas and California. When one is known to have been bitten by these ticks, and high fever and chills develop about one week later, medical care should be administered promptly.

#### CONTROL OF WOOD TICKS

It is very difficult to eradicate wood ticks from extensive areas, but certain measures may be taken to reduce their abundance in restricted localities. The abundance of all species may be reduced by clearing out vines and underbrush from wooded areas. The brush, grass, and weeds should be kept closely cut in unused fields, particularly, near dwelling places. Close grazing of brushy and weedy areas with sheep does much to reduce tick abundance. If fine-wooled sheep, such as rambouillets, or merinos, are used, relatively few ticks become engorged on them and many are killed by the wool grease. These methods render the areas unfavorable for the adult ticks, and also drive out the rodents and ground birds on which the immature ticks develop. Burning of underbrush has been thought efficacious in reducing the numbers of ticks, but this practice has many disadvantages.

In the case of the American dog tick, the most widely distributed species, considerable reduction in tick abundance may be achieved by

control of the meadow mice on which the immature ticks develop, by the use of poisoned baits. As the use of these baits involves a certain amount of danger to the operator and to domestic animals, they should be distributed with great care and under trained supervisors. As meadow mice often cause considerable losses in orchards, the Fish and Wildlife Service of the U. S. Department of the Interior has developed reliable methods for their control that are adaptable to cantonment areas.

The Fish and Wildlife Service considers starch-coated grain bait as probably most satisfactory for this purpose. This bait and its use are described by James Silver in Farmers' Bulletin 1397. It is prepared as follows:

Mix 1 tablespoon of gloss starch in one-fourth teacup of cold water and stir into three-fourths pint of boiling water to make a thin clear paste. Mix 1 ounce of powdered strychnine with 1 ounce of baking soda and stir into the starch to a smooth creamy mass free of lumps. Stir in one-fourth pint of heavy corn sirup and 1 tablespoon of glycerin or petrolatum. Apply to 12 pounds of wheat or preferably steam-crushed whole oats and mix thoroughly to coat each kernel.

The bait should be put out in October or November and again later in the winter if fresh signs of mice are present. To prevent birds from getting the bait and to protect it from the weather it is advisable to use "poison stations." For this purpose small drain tiles or tunnels made of wood or galvanized iron may be used. A teaspoonful of the bait is put in each and the stations are located in a dry place where the mice normally run. It is well to cover them with coarse brush but not grass, as the latter makes them too damp.



When dogs are kept in ticky areas they become heavily infested with engorging ticks. This not only results in loss of condition of the dogs, but increases the possibility of persons coming in contact with infected ticks, and produces numerous engorged female ticks to increase the general infestation in the region. In such cases, dogs should be kept as nearly free of ticks as possible, and those ticks which do become attached should be killed quickly. This may best be accomplished by the application of a derris dip made of 2 ounces of derris or cube powder and 1 ounce of neutral soap to a gallon of lukewarm water. (The powder should contain at least 3 percent rotenone.) It is best to make a paste of the powder with a small amount of the water, then add it to the rest of the water.

The dip may be applied by putting the dog in a tub containing it, or it may be used as a wash but in either case care should be taken to wet the skin thoroughly, as well as the hair, over the entire body. The dip can be kept for at least a week without deterioration. If the dip cannot be used conveniently, derris powder may be dusted onto the skin on all infested parts. This method is less satisfactory, and applications should be made every second day. The powder or dip must not be allowed to get into the eyes, as it is very irritating.

When the infestation is restricted to a very small area, many of the ticks on the vegetation may be killed by thoroughly applying a spray consisting of one part of nicotine sulphate (40% nicotine), 1 part of soap, and 288 parts of water. This is about 8 teaspoonfuls of nicotine sulphate and 1/2 ounce of soap to 3 gallons of water.

Caution: Remember that 40 percent nicotine is a violent poison which must not be taken into the mouth or allowed to remain on the skin. It should be kept in plainly marked containers and in a secure, safe place.



CONTROL OF THE BROWN DOG TICK

The brown dog tick (Rhipicephalus sanguineus (Latr.)), (figs. 10 and 11), is an important pest



Fig. 10 - The brown dog tick, Rhipicephalus sanguineus (Latr.). Male.

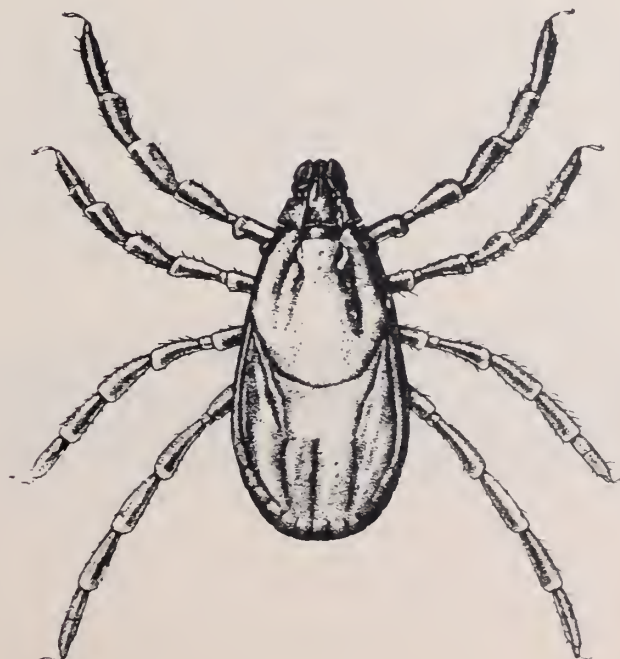


Fig. 11 - The brown dog tick, unengorged, Rhipicephalus sanguineus (Latr.). Female.

of dogs, but it does not attach itself to man. It is not known to carry any disease in this country except canine piroplasmosis, which is not widespread. It often causes considerable annoyance to man by infesting houses where dogs are kept.

The brown dog tick may complete its entire life cycle in outbuildings and residences, producing increasingly heavier infestations, providing the building is heated in winter and a dog is present on which the ticks may engorge. All the developmental stages of this tick--larvae, nymphs, and adults--engorge on dogs, and very rarely on other large animals. As in the case of wood ticks, the larvae and nymphs drop from the host to molt, and the females drop to lay eggs.

This tick is a native of the warmer regions of the United States where it lives outdoors as well as in buildings, and it is becoming widely established in the colder regions in kennels, houses, and other buildings, where it is protected from low winter temperatures.

The tick may be controlled on dogs by use of the derris or cube dip recommended for the control of wood ticks.

Infested dogs should be kept in one place, especially during their sleeping hours. This more or less confines the ticks to that place and makes the treatment easier. The kennels in which the infested animals sleep should be thoroughly sprayed with creosote oil without dilution. This material is the same as that used for the prevention of decay of posts and timbers.

Caution: Creosote oil stains and is very caustic; therefore, it should not be used in houses and should not be allowed to come in contact with animals or plants. It penetrates wood and cracks

and can be relied upon to destroy with a single treatment practically all the ticks in the building. If corrugated or other metal kennels or cages are being used it is best not to use the creosote oil but to spray with one of the creosote dips or disinfectants because the creosote oil remains on the metal and will burn the dogs. The strength of creosote dip should be used at triple the strength usually recommended on the container for disinfecting purposes. The dilution for ticks would usually be about 1 part of dip to 25 parts of water.

The use of a gasoline torch or pear-burner in concrete or other fireproof buildings is satisfactory for the destruction of the ticks in the cracks and floors.

When buildings become infested with ticks it is best to keep the dogs out of doors except when they are allowed to enter to serve as traps for the free ticks. The baseboards, window casings, and other infested places should be sprayed frequently with one of the standard fly sprays, see Circular 21, which are essentially kerosene containing a small amount of pyrethrum extract. The ticks are quite resistant to sprays of this kind and must be wetted thoroughly if they are to be killed. In addition to the spray, the use of fresh pyrethrum powder scattered behind baseboards and other hiding places is advised. If the dog is kept indoors it should be treated regularly as outlined above. The treatment of the dog and the premises must be persisted in for several months to eradicate the pest.

Fumigation of infested houses is seldom advisable because the ticks are usually present in entryways, around porches, and in outbuildings where they cannot be reached with a fumigant. Furthermore, the tick is very resistant to fumigants.



## CONTROL OF HORSE TICKS AND CATTLE TICKS

Horses and cattle are not only subject to attack by the wood ticks, but also by three species of ticks of a different type. These are the cattle ticks, Boophilus annulatus and B. a. microplus Can. the winter ticks, Dermacentor albipictus (Pack.), and D. nigrolineatus (Pack.), and the tropical horse tick, D. nitens Neum. The winter ticks are widely distributed in the United States, while the cattle ticks and the tropical horse tick occur in the extreme Southern States, in the West Indies, Central America, and the warmer portions of South America. These three kinds of ticks are similar to the wood ticks in appearance but differ in their development. The seed ticks and nymphs do not drop to the ground to molt. Thus they remain on their hosts continuously for 18 to 30 days and are therefore more easily controlled by systematic dipping or other periodic treatment. The tropical horse tick is found mainly in the external ears of horses and mules. The winter tick and cattle ticks attach to various parts of either horses or cattle. These ticks do not attach themselves to man or carry any human diseases, but cattle ticks are the carriers of Texas fever of cattle.

Individual animals may be freed of these ticks by the application of an insecticide. When only a few animals are to be treated, a derris or cube dip prepared according to the method recommended for use against wood ticks may be used, except that it should contain 7 ounces of derris or cube powder per gallon. It is applied as a wash every 2 weeks. When large numbers of animals are to be treated a dipping vat should be constructed and the animals dipped in an arsenical solution. One of the commercial concentrated arsenical dips prepared and sold for the control of cattle ticks may be diluted and used according to the directions received with the material. The arsenical content of the diluted dip should be 0.18 to 0.19 percent arsenious oxide.



## THE SPINOSE EAR TICK

The spinose ear tick, Ornithodoros megnini (Dugés), (fig. 12), attaches itself deep in the ears of most of the larger animals and occasionally in those of man. When the larvae have completed engorgement they remain attached until they molt, and the nymphs reattach themselves in the ear of the same animal. The period of attachment ranges from 1 to 7 months. When the nymphs have completed feeding they drop to the ground, where they molt to adults. The adults never feed, but mate and lay eggs without reattaching.

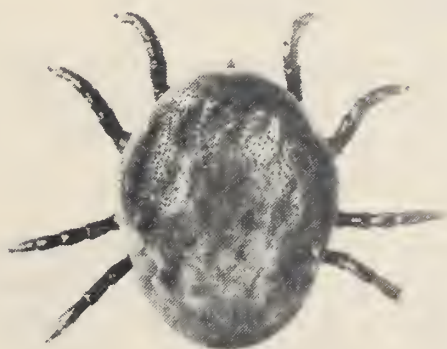


Fig. 12 - The spinose ear tick, Ornithodoros megnini (Dugés). Nymph.

This tick is a troublesome pest of horses and mules. It affects their condition and makes them hard to bridle. A single tick in a man's ear may produce severe pain and other discomfort. Infestations of the ears of men sleeping on the ground during maneuvers are not infrequent.

Small ticks are not easily seen or removed from the ears of man without suitable equipment. Usually all that is necessary in such cases is to remove them with forceps. Camps should not be located close to corrals or other places where livestock concentrate. Ticks in the ears of animals should be killed by injecting a mixture of 2 parts of pine tar to 1 part of cottonseed oil into the ears

with a syringe. This mixture will kill the ticks present and prevent reinfestation for about 30 days. It is harmless to the skin inside the ears, but should not be allowed to remain in contact with the face or other parts covered with hair, where it may cause loss of hair.

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